VOLUME 7
NUMBER 6
NOV-DEC 1961
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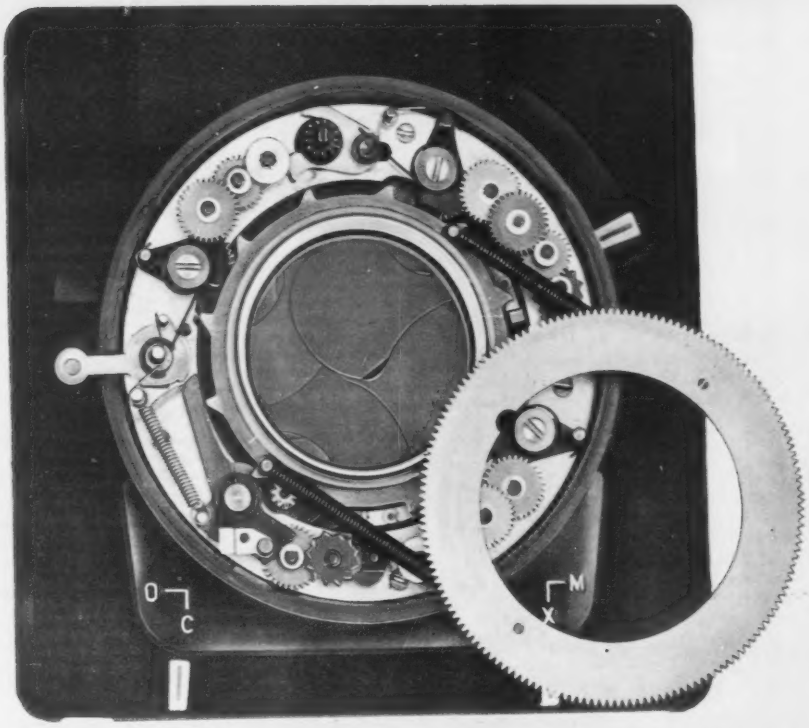

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the **CAMERA CRAFTSMAN**

VOLUME 7
NUMBER 6

NOV-DEC 1961

The Periodical of Photo Technology for Camera Repairmen

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NATIONAL CAMERA REPAIR SCHOOL. LITHO IN U.S.A.

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This Month's Cover

GRAFLEX 1000 SHUTTER

Staff

Delores Elias ____ Editor
Clair H. Schmitt ____ Technical Advisor
Lory Wells ____ Art Director
Frank H. Curtis ____ Advertising Consultant
Jim Holden ____ Lithographer
Jan Vander Beek ____ Columnist

A Point to Ponder

By SAMUEL L. LOVE

THE ART OF DOING

You'll find an interesting yard stick of American life used by economists recently. They are perceptive in seeing trends in the top executives of big business. They observe that the needs of the nation are clearly indicated by the field from which a top executive may have "graduated". Right after World War II, the top executives of many companies were engineers. This was a natural outcome of the scarcity of consumer goods during the war. The production of merchandise was the top need of the day, filled by engineers and technical men.

By the time the Korean conflict ended, a new trend became apparent. At that time sales-oriented men moved into the limelight, since the initial demand of a merchandise-hungry public had been satisfied and new sales approaches were essential.

Today, another sort of executive background is common. Financial advisors and accountants have been taking over the top spots. This is logical in cost-conscious American Industry which is becoming aware of the effect of all facets of a business on its success or failure.

How this has come about has provided background material for hundreds of writers. It is sad that we've drifted from production toward sales-now the dominant factor in American life. The ascendancy of accountants appears to be a thrashing effort to cure the result, rather than the cause of many of today's business ills.

Whereas just ten years ago, the world was our sales oyster, the tendency today is toward a world market. Producers everywhere compete for sales everywhere. The governments of free Europe and even Great Britain have recognized this with the development of a "common market", throwing away the false barrier of tariffs. Manufacturers in every free country are able to compete successfully within our own borders, and against our own manufacturers.

We Americans seem to seek the path of least resistance. We could even become a nation of salesmen, when we would sell ourselves the goods produced elsewhere. This idea is perfectly sat-

(Cont. on page 10)

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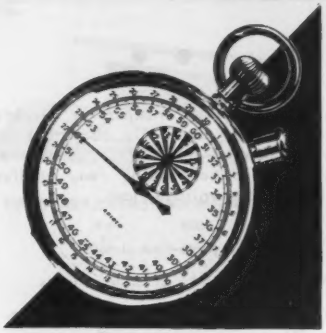

Fine quality seven jewel movement. This large size timer is especially designed so that one timer will serve every purpose. It operates from the crown for starting and stopping intermittently so that time-out can be taken, with side button for snap back to zero. It also reads to 1/10th second. The large size dial allows for easy close reading of the tenth divisions not possible on smaller watches. . These advantages are worth the difference in price.

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National Camera Holds Open House

A hundred and fifty brave guests beat their way through a "Colorful Colorado" blizzard to the orange door at 2000 West Union Avenue in Englewood, on Friday December 8th. The occasion was an open house celebrating the completion of the National Camera Repair School's new Student Services building. The 3,000 square feet masonry building, begun last July, was completed at a cost of $20,000. It became one of a complex of buildings on the school grounds housing twenty staff members dedicated to the advancement of photo-technology.

The original school building, renamed Technical Services, now houses expanded manufacturing, mailing and printing departments, as well as a model repair shop.

National Camera Repair School's facilities are ample to train 2,500 correspondence students in camera repair, simultaneously.

Besides the administration and instruction services in the new quarters, a "Seminar Room" has been provided for intensive, advanced training sessions that will be scheduled periodically for camera repairmen. Now repairmen will have facilities available for short work-shop-instruction sessions long needed in the field.

Many visitors to the school, like John Kreiling, Mayor of Englewood, said, "I had no idea of the variety of activities that I'd see taking place here." In order to acquaint first-time visitors to NCRS with the school's work, a continuous sound-slide show was presented in the registrar's office.

After this introduction to the school, visitors

(Cont. on page 6)

Reports FROM THE CRAFTSMAN

I am so enthusiastic over the way the work has been pouring in, I thought you might be interested in a few details which you have no doubt heard countless times before. I gathered from some of your testimonial letters that many students start accepting repair work before they graduate, but I didn't expect to do so well myself in such a short period of time. To say the least, I am extremely pleased with the way things are going and don't see how they can help getting better and better as time progresses.

Peter Lambert
Ontario, Canada

Thanks to the training I've completed, I am more or less self employed making special equipment for a local professional photographer. Have been putting in 12 hours every day for him and I enjoy my work. I must say NCRS has given me my first step, thru good training, toward what promises to be a fascinating career.

Laurence Nishbet
Redmond, Oregon

Not too long ago I received my ServiShops Motion Analyzer and have been using it steadily. It is a wonderful instrument and I certainly recommend it to every one doing repairs. Several of my friends, a T. V. repairman, a radio repairman, and an electrical engineer, all agree that it is well built and even said it was better equipment than they've had to work with most of the time.

Donald Forrest
Steger, Illinois

I know that the information this course has given me is being put to good use almost everyday in our photographic section. National Camera Repair School has given me the knowledge to be able to supervise the overall repair and maintenance operation in our photographic section.

At the present time, our photographic section and its repair facility is being called upon more and more to accept work from the five other photographic sections in our immediate area.

If it ever happens that we have insurmountable problems in repair work, it is good to know that NCRS stands ready to assist us in a solution to them.

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(Open House continued from page 4)

tours through the buildings gave everyone an opportunity to observe departmental functions, operation of various production machinery and other school facilities. Members of the school staff were on hand in every area to answer questions and describe special projects. In the manufacturing and repair departments, extra interest was noted in school-built instruments and test equipment.

The holiday spirit was evident in the decorations of the Seminar Room. Here, amid lights, bells and holly, visitors received further answers to questions while they shared refreshments.

"The falling snow kept many away on December 8th," S. L. Love, President of the School said, but visitors are always welcome. If you missed the open house, just drop in anytime." Telephone 789-1893 (area code 303), or write National Camera Repair School, 2000 West Union Avenue, Box 174OH, Englewood, Colorado, for directions.

SAM LOVE ELECTED COUNCILMAN IN ENGLEWOOD, COLORADO

In the November 7th election in the city of Englewood, Samuel L. Love, President of National Camera Repair School, won over two opponents to a four year council term from district 4. Also elected were Stan Miles, Reece Braun and Charles Smuckler. All are members of the Englewood People's Party.

Englewood, with a population of 35,000, is the sixth largest city in the State of Colorado and the fourth largest in volume of business transacted. Englewood is a suburb of the State Capitol, Denver. It is adjacent to the south edge of Denver and in Arapahoe County.

National Camera Repair School was organized in Englewood in 1952, incorporated in 1955 and recently moved into its expanded facilities in the south west corner of Englewood, an area annexed to the city in 1959.

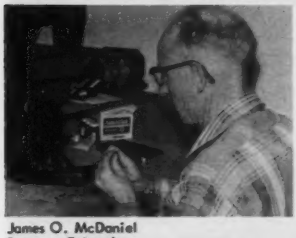
Sam Love had been active in city affairs for several years, serving on a number of voluntary committees and a city board. Love said, "It is the duty of every citizen and certainly of every business man not only to be concerned about government-but to be so concerned that he takes an active part to whatever degree he finds possible."

The new council members will be sworn into office at the Englewood City Hall Council Chambers on January 8, 1962, at 8 P. M.

study shots

HERE IS WHERE NCRS STUDENTS LEARN

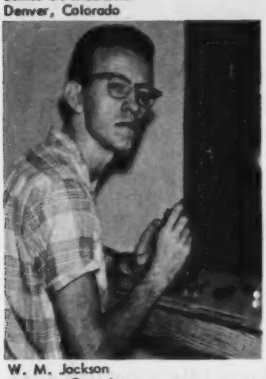
These are pictures of students in the shops they have set up for their training in camera repair.



James O. McDaniel
Denver, Colorado

Jerry E. Guyton
Reno, Nevada

Charles Iwamoto
Honolulu, Hawaii

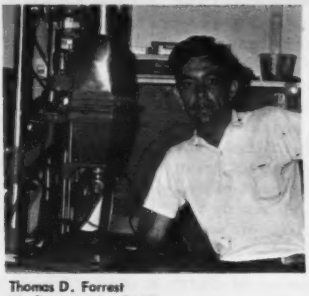


W. M. Jackson
Atlanta, Georgia

Gilbert H. Blaker
Williamstown, N. J.

Warren Hockman
Kearney, Nebraska

Arthur B. Hood
Tulare, California



Thomas D. Forrest
W. Sacramento, Calif.

Paul M. Vaska
Orlando, Florida

FILTERS

By R. D. Zakia
Hollis Todd
Continued from
Sept - Oct issue

The object is to reproduce the neutral tones (blacks, grays, whites) of the subject in the same way with the filter as without. (Of course, some non-neutral tones will be changed--this is why you use a filter.)

The value of the filter factor is dependent on (1) the color of the light source (whether daylight or tungsten, for example; (2) film sensitivity; (3) filter density; (4) the absorption region of the filter. Development of the negative also has a slight effect. In addition, since the contrast of the negative is often changed when a filter is used, all the neutral tones cannot possibly be the same in the filter negative as in the non-filter negative, if processing is the same.

Published filter factors, therefore, are only estimates by the manufacturer; they can't possibly apply to all situations. Filter factors are usually based on matching a middle gray tone. If you want to match some other tones, such as clouds which are very bright, you many need a filter factor different from the given one. The filter factor also changes to some extent with every different light source and film and use.

You can readily find your own filter factor for any light source and film by including a calibrated reflection gray scale in the picture area. Light the gray scale evenly, and make two negatives--one exposed with and the other without the filter being tested. Use the same camera settings in exposing the two negatives, and process them similarly. When you view the processed negatives, you'll see that the negative exposed with the filter has lighter tones in the gray scale than the negative exposed without the filter. By sliding one gray scale image along the other, you can match the tones approximately. By referring to the table, the number of steps displacement you must use to match tones will give you the filter factor.

The types of materials used in filter manufacture bear strongly on the quality of the filters and the results you can expect from them. Filters do vary. The heart of any filter is the dye it contains. This dye is supported uniformly by gelatin, glass or plastic.

Permission granted to reprint from Modern Photography, July 1961 issue.

The grade of glass used in all glass and laminated filters may differ in optical quality. Some filters are available in two grades, A and B. Class B filters are adequate for general photographic work, including photomicrography and spectrography. For maximum quality and precision under conditions necessitating long focal-length and large aperture lenses, class A filters are recommended. These filters are more expensive than class B.

The dye medium plays a very important role in the optical characteristics of a filter. For top quality, the gelatin-only filter is the least expensive and optically the best of all. Gelatin filters cemented between glass, as well as solid glass filters, would be made from glass of high optical quality and flatness. (Never attempt to cement a gelatin filter between two pieces of lantern slide glass, since this is not much better than plain window glass). The flatness is obtained through expensive polishing.

All plastic filters vary considerably in their flatness, and this variance limits their use. Plastic filters, such as the acetate variety, are adequate when used as safelight filters or between the light source and the negative in a printing system. (Note: experimental work is being done on various plastics to improve their optical qualities).

While surface flatness is important in both black-and-white and color photography, the actual color of the filter is not too critical in most black-and-white work. It is, however, in color photography. For example, a Wratten 85 filter looks yellow because it absorbs blue light. But looks alone can be misleading and costly. You will find many 85 type filters that look alike, but if you tested them on an instrument such as a spectrophotometer, pronounced differences would become evident. Such difference are very important, for the film in your camera discriminates in much the same manner as a spectrophotometer. The results are subtle (and sometimes not-so-subtle) differences in your color photographs.

A word of caution about filter purchasing: most manufacturers will state that their filters are made with optical glass, that they are flat, coated, etc., and indeed their claims are true. The important questions, however, are: What quality of optical glass; what degree of flatness; what type of coat-

ing and how effective, etc. ? Remember that you get what you pay for. If you want top quality and want it consistently you must be willing to make the required investment.

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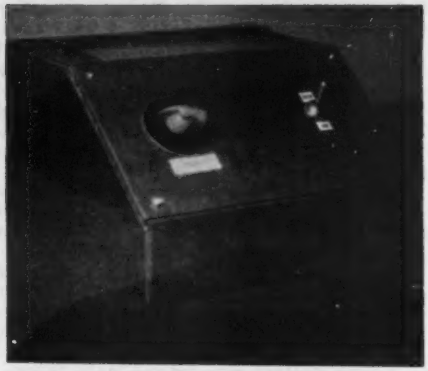
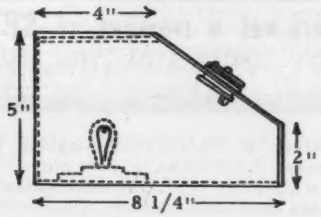


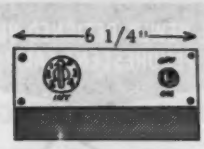
METER CHECKER

Mr. Robert L. Miles, NCRS graduate #1205 built this instrument for routine checking of light meters. Several light meters were obtained that were known to be operating correctly and checked as they were held close to the groundglass. The reading varied, but the average was close enough for a fairly accurate calibration. The instrument works very well for all meters.

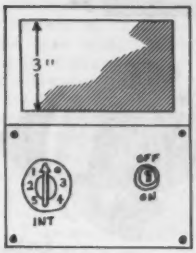
The following sketches by Mr. Miles shows the dimensions and approximate location of the parts.



Side View



Front View



Top View

Parts: Light socket, 25 watt bulb, 1.000 Ohm Rheostat, Toggle switch, Hookup wire, Plate for calibration, Pointer for plate, Groundglass or diffusing glass 3" x 6 1/4".

If you have made one similar and would like to exchange ideas, Mr. Miles would like to hear from you. His address is: National Camera ServiShops, 90 West Main Street, Woodland, California.

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(Point To Ponder continued from page 3)

isfactory, as long as everyone uses the same system of exchange (or money). Generally the earnings of producers and sellers is fairly well distributed.

If we reached the point where all goods were produced elsewhere, we could easily use up all available world currency to purchase merchandise - and have only inflated dollars to pay ourselves for selling that merchandise to each other. The key to reversing such a trend lies in the hands of people like you. The skilled craftsmen is still capable of producing quality at realistic costs. When America's farm population migrated to the factories, farm production still remained high through efficient use of the land. Today's migration to sales is not accompanied by a similar efficient maintainance of production.

There's no denying the vital importance of sales. But sales alone is not enough to sustain any group of people. In addition, it seems the method of sales is changing radically. The salesman used to be a doer or producer as well. A photo shop clerk was an instructor and guide to his photographer customer. The sales makers now are high-priced national figures. This may be the path to mass sales but could lead to disaster. Fewer dollars may be available to purchase goods manufactured for realistic prices elsewhere because more of the available dollars must pay the exorbitant cost of selling a product that we should be able to manufacture and sell efficiently.

This is certainly not intended to be a "voice of doom". It will be interesting to see who the next industrial executives are and what reasons are provided by the economists for the change that occurs. Will the financial wizards prove themselves only result finders? Will the trend be back to the technicians and engineers as it remains elsewhere in the free World? Or will the salesmen who still retain such a strong hold on our economy regain the power they nominally held five years ago?

If you are not a member of SPT,...

THE NEXT SECTION OF THIS ISSUE IS MISSING

The Society of Photo-Technologists section of the Camera Craftsman is sent only to members of the Society. Don't miss the valuable articles in this section!

Write: The Society of Photo-Technologists
Box 174, Englewood, Colorado.

Measuring and Testing LENSES

Continued from page 20

by G. Barnstedt

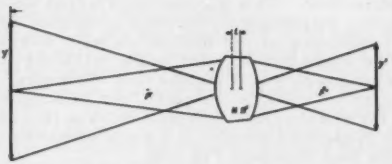


Fig. 25 Measuring the focal length from the ratio of magnification, when the distance e between object and image is known

In order to compute the principal plane distance, the focal length should already be known. Therefore the focal length is computed first, without taking into account the distance of the principal plane, then checkingon the exact value. This is not really essential in series-measurements, since here only relative values are of importance. So far, measurement is quite convenient, since no optical viewing equipment is employed. It is therefore necessary to calculate with a margin of error amounting to ± 0.5% in absolute measurements,and of ± 0.1% in comparative measurements.

Measurement by Newton's image - formation equation.

An additional important relationship involving the focal length, is Newton's image-formation equation $zz'=f^2$. There are a wide variety of techniques which can be traced back to this formula; the following should be metioned. For the use of this formula, the following data must be known: the back-focus s_k of the collimator (set to infinity), the front focal intercept s of the lens under test, the meniscus-height d_k of the collimator lens and the distance P between the two facing lens apices of both the collimator lens and the test lens. Alternatively, it must be possible to compute or measure by other means the distance z between the test object and the front focal point of the lens under test.

First focus on the ground-glass screen the image depicted by the lens under test of a collimator test-object at an infinite distance; it is thus located in the focal plane. Then remove the collimator lens, so that the test object is now at a finite distance, and focus the image once again. Then move the ground-glass screen through the distance z; this distance consists of

$$z = s_k + d_k + p - s$$

Formula 26

However, with this method, satisfactory accuracy can only be obtained by measuring the displacement z' by photo-electric methods of focal-plane determination, and moreover, if the distance z is not greater than 10 f'. In these circumstances one can still assume a measuring - error of only 0.2% approximately. This technique is of especial importance when the focal length has to be used for computing the distance-setting graduation of a lens, since the variations of correction for near-focusing are taken into consideration.

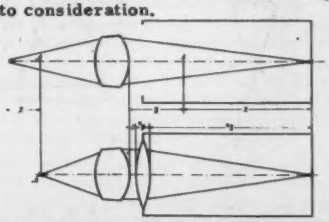


Fig. 26 Measuring the focal length by displacement of the focal plane when focusing on nearby object, with the aid of Newton's image-formation formula $zz'=f^2$.

Abbe's Focometer

As has already been mentioned, most of the values obtained by measurement depend upon focusing on the image position. In order to avoid these and other errors, Abbe has laid down several conditions "for micrometric measurement by means of optical images". We will now describe the techniques for measuring focal length, which Abbe has evolved from these basic rules.

Within the image space of the lens, 2 scales are placed at varying distances from the lens apex. The distance between them is z. These scales should be viewed with a telescope through the lens. The telescope axis must be parallel to the lens axis and movable at right angles to it. The telescope is moved laterally (the axes before and after movement remaining parallel) through a given distance 2h. The two scales should be viewed at the two terminal positions and the appropriate distances y'_1 and y'_2 should be measured on the two scales (Fig. 27). There is another method, in which the lens being tested is moved instead of the telescope; this provides greater accuracy of measurement, since it is difficult to move the telescope while keeping the optical axes as precisely parallel as is required. The parallism of the lens test need not be maintained quite so strictly (Fig. 28).

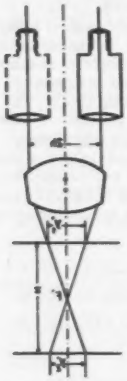


Fig. 27
Abbe's Focometer; Original Design

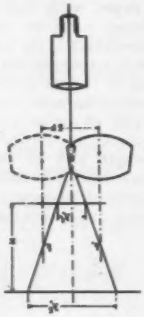


Fig. 28
Abbe's Focometer; Later Design

The focal length is computed from the resultant values, thus:

$$f = \frac{2\,h\,z}{y'_1 - y'_2}\,.$$

Formula 27

This technique is not suitable when a mean value of the focal length must be measured at the full aperture of the lens. However, it is suitable for determining the focal length of the various zones, in that the paraxial focal lengths, which cannot be measured directly, can be interpolated. The error involved in this method is approximately 0.1%.

Measurement and Assessment of Lens Performance

It has already been stated that it is impossible to produce an ideal lens, which will unite in one image point all rays coming from one object point. The first reason for this is that only a small portion of all rays actually enter the lens; as a result the object point is depicted as a diffraction disc. This disc becomes larger the further the diaphragm of the lens is stopped down. The influence of the diffraction will, however, not be taken into account in the following text. The second reason is that the rays which enter the lens do not unite in one point, but on account of the various aberrations from a more or less complex dispersion pattern in a plane perpendicular to the lens axis (see Fig. 29).

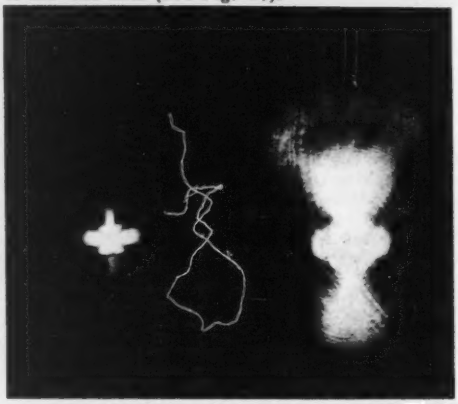


Fig. 29 Dispersion Patterns: point-object photographs taken at varying exposure times, showing (left) the structure of the nucleus, (right) the amount of veil. Mag. approx. 500x.

Rays parallel to the axis, entering the lens at a considerable distance from the axis, will not intersect the axis at the same point as rays which enter close to the axis. This phenomenon is still more noticeable (for its asymmetrical behavior) in rays entering the lens at an angle: this form of image aberration is called coma. The dispersion patterns resulting from these two aberrations can easily be reduced by stopping-down the lens and preventing the marginal rays from forming an image. But the image of an axially-perpendicular plane is formed on two curved surfaces, on one of which all straight lines passing through the axial point are depicted sharply, and on the other all circles around the axial point. These are referred to as the sagittal and meridional or tangential image shells; the mean curvature between the two is known as the image-field curvature, and its distance as astigmatism. Moreover, the subject plane will not be depicted at a uniform image scale, since the focal length which is responsible for the image scale is somewhat dependent on the inclination-angle of the incident rays. These image aberrations are known as distortion. Finally, the magnitude of all these image errors depends on the wavelength of the light (chromatic aberrations).

The task of the lens computor is to keep all these aberrations as low as possible, by the selection of suitable design data, so that they are least noticeable in photographs taken with the lens in question. The assessment of the performance of the lens begins during the computation, by making a diagrammatic illustration of these various aberrations (Fig. 30).

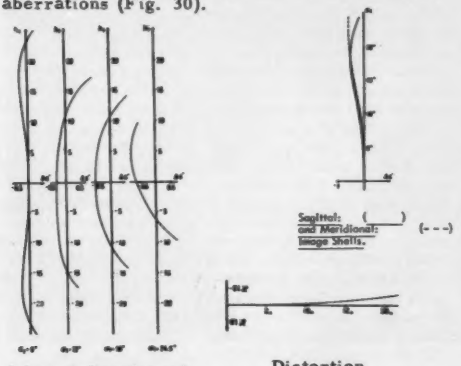


Fig. 30 Illustration of Image Aberrations (M. von Mohr; 2.3x reduced; moreover the same abscissa-scale has been selected for b as for a).

The paths of individual rays through the lens are then plotted. Formerly, the ray paths were only calculated for a few angles, and moreover, only the meridional rays which are those passing through the axis and the plane depicted by the principal ray. The modern pre-programed electronic computors make it possible to compute the paths of any rays selected without great expense. For this reason, sagittal rays are now also plotted, i. e. those which enter the lens in a plane perpendicular to the meridional plane. Moreover, a thicker bundle of rays can be plotted. Besides the aberrations illustrated in Von Rohr's diagram, it is also possible to plot the course of rays in the vicinity of the image point and in this way achieve a comprehensive picture of the quality of the fusion of the rays (see Fig. 19).

By this method of plotting individual rays entering the lens in two cross-sections perpendicular to each other, it is possible to select those rays which represent the whole mass of rays entering the lens. Here it is assumed that those rays which are ignored behave in a manner not significantly different from the computed rays. This is not the case, however, with the most modern and highly-evolved lenses. Therefore, incident rays are occasionally selected, which are distributed uniformly over the entrance aperture. Their points of intersection in the focal plane are plotted in a diagram, and the distribution of intensity in the image point can be judged from the density of the rays.

In the computation, one starts from the assumption that an image is recorded by the lens system and then judges the shape of this image. In actual practice, however, the object does not consist of points, but of lines, contours and planes. In their reproduction it is necessary that the fine details of the object should be recorded as being clearly separated, and with the correct contrast. Therefore, the efficiency and performance is characterized by the resolving power and the contrast reproduced. Neither of these terms are fully-defined conceptions: they tend to be combined in the form of a "contrast-transmitting factor". This denotes the extent to which the contrast of a grating with a definite diffraction-constant is retained in the image. This type of computation can only be approximate; the cost of detailed accurate computation is so extraordinarily high that its practical use in the computation of normal lenses is not generally undertaken.

Practical testing can be performed in the same way as the computation, by following individual rays on their path to the image point, after which the aberration curves can be calculated from the measured values. By observing the dispersion patterns which are formed by the depiction of a single point using the entire lens, it is easy to extend one's observations from dots to lines, con-

tours and grid systems, and so measure (by relatively simple procedures) the resolving power, or, better, the "contrast-transmission factor". However, the principal aim in testing the performance of lenses is to start where calculation reaches its limits: not as a matter of principle, but on account of the expense involved. Since it is difficult to compute, as described above, quantitive data concerning the performance of a lens from the degree of correction, it is better to allow practical tests to assist the computation, and so provide numerical data concerning the performance and if necessary suggestions for the improvement of the degree of correction.

In order to assess the degree of correction, it is important to determine the image plane under definite conditions, i. e. in relation to the incidence-height of individual rays (spherical aberration, coma) or the incidence-angle of the rays (field curvature, astigmatism, distortion) and further, in relation to the wavelength of the light (chromatic aberration). On principle, the most suitable photo-electric and visual methods of determining the image plane should be employed for this purpose, for which only a few aids are required, such as aperture rings placed on the front of the lens. The aperture of the rings should be variable to permit measurement of the spherical aberration of individual zones.

The values obtained by means of such visual measurements will frequently be insufficiently accurate for the purpose in hand, particularly at low heights of incidence. For this reason, a series of techniques have been evolved, which by the use of special measuring apparatus increase the accuracy of the determination.

The most precise of these methods employ interference phenomena, in which wave-fronts altered by the aberrations of the lens are compared with the original, as in the techniques of Vaisala or Twyman . These interferometers are, however, on account of their sensitivity, extremely prone to breakdowns and are difficult to operate. The quantitative evaluation of their findings is by no means simple. For these reasons this technique is not generally practiced.

The Hartman Extrafocal Method

Of all geometric optical methods, that of Hartmann is most accurate. It is suitable for assessing the distance between back lens and image at various heights of incidence, i. e. for estimating spherical aberration and coma, as well as astigmatism and its color deviation. This method makes use of a diaphragm with two fine apertures placed in front of the lens, by means of which two rays symmetrical to the axis are masked out from the parallel incident bunch of rays. At the rear of the lens these two rays intersect at the zonal focal point. In two arbitrary planes behind the lens, preferably in front of and behind the focal point, the distances y_1 and y_2 between the two rays should now be measured. This can be done by taking direct measurements of the ground glass screen images with a suitable measuring microscope, or by exposing photographic plates placed one after the other in these two planes and measing from the negatives. Moreover, the position of the planes on the optical axis relative to a selected zero point should be known, for instance, relative to the rear apex of the lens or relative to the focal point of the near-axial rays. When, for instance, z_1 and z_2 are measured, the distance z_f of the focal point of a definite zone from the zero point is calculated by the formula.

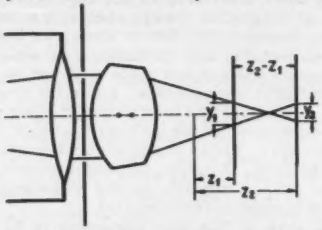


Fig. 31 Measurement of the image aberrations employing the Hartmann extrafocal method.

This should be repeated with several aperture discs with apertures at varying distance and thus the focal point for each zone, that is, the spherical aberration, will be obtained.

When measuring at an angle to the axis in order to determine the coma, a lateral ray and one passint the center of the entrance pupil should be taken instead of the two lateral rays, because the meridional coma is asymmetrical; both rays are in the plane of rotation. For measuring the sagittal coma, the upper and the lower ray can still be used. Both lie in a plane vertical to the plane of rotation. The measurement of both the meridional and sagittal image shell is formed by using one each of a pair of rays lying as near as possible to the axis, yet removed far enough to afford exact measurement. In order to save time, there is no need to use a series of diaphragm discs with varying aperture distances; a diaphragm with a V-shaped aperture can be substituted to make distance-adjustment easier.

Cont. page 25 (next issue)

We are indebted to Mr. Norman C. Lipton, Photographic Information Service, New York, N. Y.; and Jos. Schneider & Co., Optische Werke, Kreuznach, Germany for what we believe is a very informative article on "Measuring and Testing Lenses." -Ed.

ROCKY MOUNTAIN CHAPTER OF AMERICAN SOCIETY OF TRAINING DIRECTORS ELECTS NEW OFFICERS; HOLDS SPECIAL WORK SHOP.

"Probably one of the most worthwhile affairs the Rocky Mountain Chapter ever sponsored was the work shop on Programmed Learning and Teaching Machines held Tuesday afternoon and evening, November 28th, at the Continental Denver." Thus opened the special report of Raymon Meyer on this exciting November session. One hundred and eleven participants worked with Dr. Robert deKieffer, Dr. Donald Mason and Dr. Donald Stilson in an enthusiastic program that lasted from 1 p.m. until 9:30 in the evening. The program was packed with discussion and information on programmed texts, scrambled books, simple write-in machines, multiple-choice machines (punch boards, self scoring machines, and discrimination machines), subject matter trainers, and automatic tutoring machines.

The successful work shop was organized by Flora Goforth, Stan Youngblut, Marion Andrew, Ray Meyer, Liz Fulkerson, Stan Chamberlain, Bill Neu and Martin Leising. The chairman for the day was Claude Deats, President of the Rocky Mountain Chapter of A. S. T. D.

New officers elected to head the Chapter for 1962 are Samuel L. Love, President; Lauren Chamberlain, Vice President; Jean Johnson, Secretary; and Martin Leising, Treasurer.

EDUCATIONAL DIRECTOR HONORED

Mr. Clair Schmitt of National Camera Repair School and Mrs. N. B. Dodge of the Colorado Education Association record on film the more than 300 per cent increase that their organizations and employes gave to this year's fund campaign. The two were honored at a United Fund report luncheon recently.

The BERGEON Screwdriver Sets are the finest precision screwdriver sets made. Produced in Switzerland by an organization producing for the Watchmaker and Jewelry trade since 1799 — OVER 170 YEARS! World renowned . . . World Used!

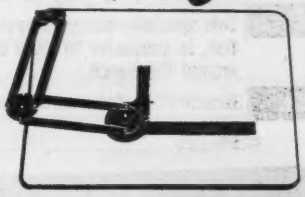
Set consists of 5 sizes — Blades measuring .50 - .60 - .80 - 1.00 - 1.20 m/m; perfect for Camera Repair — with aluminum tubes containing 5 each extra blades. Set is beautifully finished and housed in a polished hardwood case.

#2639 ..... Freight Free within USA $10.50

draftette®

Complete with 10" x 13" drawing board . .	$5.95
Draftette instrument only . . . . . (Scale 3" x 5" — 6" arms — 180 degree protractor, Draftette completely assembled — ready for use.)	$4.95
Draftette with 4" x 6" scale and 11" x 17" Drawing board — Complete	$8.50
Draftette 4" x 6" scale alone	$2.00

draftette® Complete with 11" x 17" drawing board only $6.50



NATIONAL CAMERA ServiShops

Box 174 • Englewood, Colorado

THE NEW VIGOR 19 DRAWER LIFETIME BENCH

Specially designed for Precision Workers • Camera Repair Men • Hobbyists • Industrial Workers • School Shops • Instrument Makers

SIZE 38" high, 20" deep, 39" wide.

DRAWERS 19 drawers — all made of kiln-dried wood with reinforced construction permanently joined and unconditionally guaranteed not to warp or twist out of shape. Whenever production permits, the drawers run on metal runners assuring smooth and even operation. Each drawer has an easy gripping drawer-pull that is functional as well as decorative. The drawers range in depth from 1" to 5½" deep and widths of 3¼" - 3⅝" - 7¼" - 14¼". Another important feature of the specially constructed drawers is the 2¾" long drawer extension which prevents the drawer from dropping when pulled to its very end.

TRAY Full width — catch-all tray measuring 20" wide and 17" long with heavy canvas covering.

TOP Top working surface is made of ¾" extra hard BIRCH — beautifully finished for long and effective use, enclosed on 3 sides with 1¼" high ledge and the front has a ½" wide groove running the full length of the bench ½" from the edge. This arrangement is an important safety factor — catching many parts that have a tendency to roll, fly off the tweezer or jump under pressure, etc.

BASE This specially designed open base has a reinforced foot rest which permits better ventilation, is conducive to more comfortable working position and allows for easy "cleaning-up" around the bench.

FINISH Beautiful, modern, natural finish BIRCH.

#BN-225 ..... **$124.50**
Freight Free within USA

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Box 174 • Englewood, Colorado

ServiShops SUPPLY

Your
ServiShops
QUESTIONS...

By Clair Schmitt, Editor

? ? ? ? ? NEED HELP ? ? ? ? ?

In this column I'll try to answer any camera repair questions you may have. Names will be withheld if requested. Address your questions to: Clair Schmitt, The Camera Craftsman, Box 174 CC, Englewood, Colorado.

Are the cost chart and the time estimator an average with the one-man shop or are they set up for National Camera ServiShops to "stay in line" so as not to under or over charge? Carl J. Wild

The cost chart and time estimator that you have are indeed an average or typical charging system. You could change your rate per hour and still use the same time estimator, of course. It is not intended for National Camera ServiShops to "stay in line" since different shops might come up with different rates per hour. The flat rate chart, however, can give you an indication of the average amount of time required to complete a particular repair so that even though you take more or less time than this, you may still charge a fair fee for your work. For someone with a minimum of skill more time might be required. As you gain skill and experience, you can probably beat the time shown on the time estimator and still collect a fair fee. I would certainly recommend starting with the time and costs shown whenever you work with a dealer, indicating to him that quality work required time to complete and a fair return.

Q. How do I get a cover plate off a shutter on an Ansco Titan 120 Camera?

Ben Lasser

A. Loosen three set screws visible around the focusing ring, with the lens set at the infinity position. Then lift the focusing ring from the front cell mount immediately below. Using a 1" flexi-clamp wrench around the center cell mount (do not remove the front cell) so that the split in the wrench straddles the infinity stop, unscrew the center cell mount. This may be quite tight but with the front cell in place the added pressure needed should not damage the center cell mount. Once the center cell mount has been removed the cover plate retaining ring can be unscrewed and the plate lifted from the shutter.

HELP WANTED

A card to NCRS Placement Service will bring more details about these opportunities. Include code number listed for opening that interests you.

1201 Our company would appreciate applications from graduates of National Camera Repair School. North Hollywood, California.

1915 Hobby Shop wants two National Camera Repair School Graduates for expanding repair department. Detroit, Michigan.

1916 Well established shop located in Rapid City, South Dakota, needs two more people.

11113 Need repairman who knows focal plane shutters and foreign made cameras. Portland, Ore.

11115 Need Audio-Visual repairman. Knowledge of sound projectors and tape recorders. Boston, Massachusets.

11120 Well known firm has a vacancy for NCRS graduate in their service department. Hollywood, California.

1116 Camera repairman needed who has had experience on Mitchell, Arriflex and Bell & Howell cameras. New York.

1117 Adding camera repair department and need experienced repairman. Tucson, Arizona.

1822 Will interview NCRS graduate for repair and maintenance of photographic equipment. Van Nuys, California.

1925 Will interview camera repairman who knows focal plane and foreign made cameras. Portland, Oregon.

1113 Need a man with general knowledge of photographic equipment and repairs. New York.

1918 Have opened a repair department and need one more experienced repairman. Pittsburgh, Pennsylvania.

1707 Photo and Music Shop needs graduate camera repairman in modern establishment. Miami, Fla.

Dealers --- Repairshops --- Service Departments

When you need repairmen, send details to NCRS Placement Service. Your needs will be listed here. Applications of interested repairmen will be sent for your consideration.

Lindstrom PLIERS

FLAT NOSE PLIERS

Size	4"	4½"	5"
Bright finish Cut jaws	$1.80	$2.00	$2.20
Bright finish Sm jaws	1.90	2.00	2.20

HALFROUND NOSE PLIERS

Size	4½"	5"
Bright finish Smooth jaws	$2.10	$2.30

END CUTTING NIPPERS

Length	3½"	4"	4½"	5"
Bright finish	$2.25	$2.35	$2.50	$2.80

ROUND NOSE PLIERS

Size	4"	4½"	5"
Bright finish Sm jaws	$1.80	$2.00	$2.20

CHAIN NOSE PLIERS

Size	3½"	4"	4½"	5"
Bright finish Cut jaws		$1.85	$2.00	$2.10
Bright finish Sm jaws	1.80	1.85	2.00	2.15

SIDE CUTTING NIPPERS

Size	3½"	4"	4½"	5"
Bright finish	$2.25	$2.35	$2.50	$2.80

NATIONAL CAMERA ServiShops SUPPLY

Box 174 • Englewood, Colorado

Hi There!

from Jan VanderBeek

Hello again! Here's a snow-ball full of tidbits for you! 'Course we never have snow for Christmas so a New Year one!

We've had a few more visitors lately and even though they may come from some place warmer they seem to enjoy it here. So different you know! Mr. Lee, from New Mexico, spent some time and hard work in the shop, he's on the way to finishing his course. Chicago, the windy city, blew in one of our graduates, Mr. Fritz. He took an Analyzer home with him. Mr. Thomas from Idaho also spent some time in the shop. Now he has finished his last lesson and has talked his son into enrolling also. Mr. Thomas will be receiving his diploma soon. It's always so nice to welcome another graduate to NCRS.

Our Open House was a wonderful success! A lot of people battled snow and slippery roads to view the new Student Service Building and the changes made in the Technical Services Building. This was a big stepping stone for a wonderful future for you, our wonderful students and our 'family' here who try to keep you busy. We certainly want anyone who visits the Denver area to visit us.

The MPDFA Convention is already being planned for 1962. It will start March 5th and continue for 5 days. NCRS will have a booth again this year and anyone in the Chicago area, please drop in! Booth #221.

Oh, if any of you are wondering about your textbooks, some are being revised and a new type of procedure sheet is being printed. We're trying once again to help make things easier to understand and time saving! You now return your lesson in the same envelope you received your text book in! Simple isn't it? It also may save you an envelope if you have run out! Of course, any suggestions are always welcome.

A couple more thoughts before your gossip columnist signs off again!

A pleasant word or a smile, at the right moment, has solved many tense situations.

Have a Happy New Year everyone, really we all should you know, cause it is up to ourselves to make it that way!

Our Students Speak

I started a year ago this month and am now half way through. My earnings have more than twice paid for the course and I haven't pushed the business at all, thinking that I needed certain training that comes later before I really started in earnest.

William V. Porter
Joplin, Missouri

The course is very complete and covers any problem that may come up in photography or camera repair.

C. T. Gust
Portland, Oregon

I still remember with a great deal of satisfaction my two weeks spent at the school. I enjoyed every minute of it and the help that Bud gave me has certainly paid off, especially on the Exakta.

L. P. Green
Santa Cruz, New Mexico

I have enjoyed the course and strongly recommend it to anyone interested in our field, as a most complete and comprehensive course. I look forward to my resident schooling as soon as I am financially able.

Dick Wilson
Missouri

I have enjoyed every minute of this course and in lots of ways I hate to see it come to an end. I certainly want to express to you, Mr. Love and Mr. Fowler, my sincere thanks for all you have done to make this course so interesting.

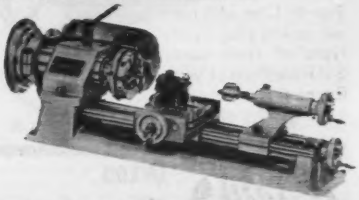
I certainly want to continue my contact with the School and also receive the Camera Craftsman. Do you have an Alumni Assoc. that I can join?

I have used my vacation for this year so it looks like it will have to be next year before I can visit the School.

Larry Burton
Bala Cynwyd, Penn.

UNIMAT

Unimat is a precision tool designed for technicians and engineers. It's readymade for Camera Craftsmen. No bigger than a typewriter, Unimat is a combination of 10 tools in 1, operating on just one base. Widely acclaimed as the finest tool ever developed for machining small parts made of metal, wood or plastic, Unimat is a rugged, portable machine that will provide a lifetime of satisfaction.



Basic unit consists of the precision lathe and all components necessary to set up drill press, milling machine, tool and surface grinding machine, hand drill, grinding and polishing machine. Also includes motor, upright steel drill press post, universal 3 jaw (reversible) self centering Cushman type lathe chuck, 3 jaw Jacobs type 1/4" capacity drill chuck, pivoting tool post, 2 dead centers. Face plate, lathe dog, grindstone arbor, Allen wrench, easy to follow instruction manual. Unimat basic unit comes handsomely packaged in sturdy wood storage chest. Complete basic unit, priced $129.50

Items 1 through 5 are included in the basic unit. Items 6 through 9 are accessories. Write for illustrated literature and price list.

NATIONAL CAMERA ServiShops
Box 174 • Englewood, Colorado

Tap-A-Line

IN YOUR WORKSHOP: Tap-A-Line permits you to plug in soldering irons, test lamps, flex shaft, other equipment. Has them all ready and available for immediate use.

IN YOUR STUDIO: Tap-A-Line is convenient for portable lights, flood lights, spot lights.

On Your Test Bench: Tap-A-Line will permit you to plug in all types of flash cords and have them at your finger tips.

Model TL 1 foot $2.00

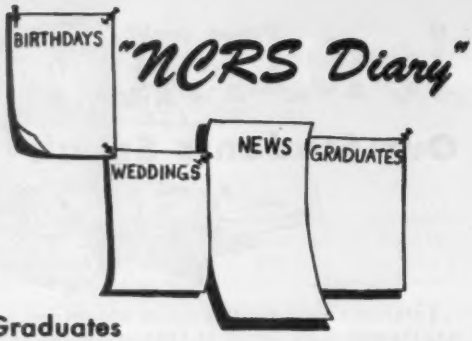
new

Dixon Miniaturized Tools

You've seen handy screw-holding drivers for the auto trade . . here's a miniature that's terrific in instrument and camera work. The jaws adjust automatically to hold screw straight and securely --no more stripped threads or lost screws. Ends awkward groping in hard to reach places. Set screw locks screw holder at any setting. Taper streamlining of screwholder section helps you get into tight places. $3.40

A companion miniaturized tool! The right tool for the job is essential in camera repair. This miniature Hand Drill eliminates fumbling with tools too large and bulky for precision work. Accommodates drills or taps in sizes 50 to 80 on twist drill gauge. You'll find it indispensable in your well equipped shop $3.50

A ServiShops PRODUCT



Graduates

D. H. Hendrickson	Colorado
Hugh Shewmaker	Colorado
John E. Hulten	Iowa
Robert Wm. Miller	Michigan
Jerry E. Guyton	Nevada
Matthew E. Hopkins	New York
Lloyd F. Bazant	Oregon
Lawrence H. Burton, Jr.	Pennsylvania
Daniel Feely	Pennsylvania
William Rizzo	Pennsylvania
Ignacio Montalvo	Puerto Rico
Arlen L. Hansen	Utah

Necrology

Mr. William F. Crick of Kansas City, Missouri died October 12th of a malignant brain tumor. He was sponsoring student #1975, Duane C. Scott who now has taken over the management of "Crick's Camera Shop". Mrs. Thelma Crick, a partner in the business for fifteen years, will continue operations.

Mr. Will Connell, editor for over twenty years and popular columnist in photo publications died in October.

Student #2218, Mr. Larry Riedel, died December 12th. Larry was well known to everyone here at NCRS because he lived in the area and dropped in often.

After a lingering illness, Mr. Floyd A. Martin student #2428, passed away December 11th. Mr. Martin was half way through his Course and was well on his way to being an honor graduate.

Births

The annual School Christmas dinner held Dec. 16th was an offset to the birth of a 7lb. 11oz. son to Mr. & Mrs. Jack Olson, our Analyzer specialist.

BELLOWS

Have we heard from you lately?

I feel very bad because this lesson completes the series for me. I have enjoyed them very much. I have also gotten a great deal out of corrections on my assignments and my association with the instruction (thru the mail) with the exception of Mr. Love and Mr. Schmitt, who I met here in Philadelphia several times. The man who deserves a lot of thanks is Bud Fowler and I sure hope I can have the pleasure of meeting him some day.

Larry Burton
Bala Cynwyd, Penn.

I have been intending to write and let you know how I am making out, but just couldn't get to it. We were in Las Vegas for 5 weeks where my wife was attending school and I was spending several hours each day with my grandchildren. At the same time I was trying to do some camera repair, and had to make some week end trips back to my shop in Santa Cruz, 100 miles each way. It has been rather frustrating, but now we are back home and I am up to my ears in repair work trying to catch up.

I have really had some "puzzlers" and thought I was going to have to write to the school for help but my determination to "conquer" finally brought me thru.

L. P. Green
Santa Cruz, New Mexico

The Camera Craftsman deserves more than mere mention. Let us hope it can be expanded and published monthly. I am sure most of us receiving it would find no objection to a subscription price in line with the popular photographic magazines that carry so little of interest to repairmen.

It is my hope that I shall be able to visit the School again someday and renew acquaintance with all you wonderful folks!

C. L. Wilson
Mercedes, Texas

KENNEDY *all steel tool kits*

Positive spring stop prevents accidentally pulling drawer all the way out of cabinet. Spring catch can be released for quick removal of drawer.

The Kennedy line offers outstanding economy and value when fine tools are to be stored. Solidly built--reinforced by inside walls, which ensure rigidity and also support the drawers. The Model 520 has seven drawers sized to fit a wide variety of small tools. Compound drawer slides are equipped with positive stops which prevent spilling. Patented spring catches make it easy to remove drawers. All drawers are completely felt lined and can be drawn out their full length for a clear view. Slides work easily and smoothly without sagging even when heavily loaded. Adjustable partitions in each drawer except the bottom one.

Front panel slides underneath drawers when box is in use -- friction catch holds it there. Fits outside, holding drawers closed for carrying (locks with lid lock). Bright zinc plated fittings make attractive combination with brown ripple baked enamel finish. Dimensions: 20 x 8-1/2 x 13" Weight 27-3/4 lbs.

Till in Top	20 x 8-3/8 x 3-3/4
Four Drawers	8-5/8 x 7-1/2 x 1
One Drawer	8-5/8 x 7-1/2 x 2
One Drawer	18-1/4 x 7-1/2 x 1-1/2
Bottom Drawer	18-1/4 x 7-1/2 x 2-1/2

MODEL 520 $31.95

The #620 chest has the same rugged construction and time-saving convenience features as the #520 described above. Equipped with three drawers -- top one has four adjustable partitions. Dimensions: 20 x 8-1/2 x 13". Weight 26 lbs.

MODEL 620

$25.95

Till in Top	20 x 8-3/8 x 3-1/4
Top Drawer	18-1/4 x 7-1/2 x 1-3/8
Middle Drawer	18-1/4 x 7-1/2 x 2-3/8
Bottom Drawer	18-1/4 x 7-1/2 x 3-1/4

A ServiShops PRODUCT

SERVISHOP PRODUCT GUARANTEE

When you purchase a ServiShops product, you are sure you're getting the best of equipment. Every product advertised in the Camera Craftsman carries three warranties.

First, you have a ten-day return for refund privilege. If, for any reason, you're not satisfied, you can return your order within 10 days of purchase, for a full refund.

Second, all materials and workmanship of NCRS manufactured products are guaranteed by NCRS for one full year. NCRS will replace any parts or components which might become defective in normal use, if returned to the factory, transportation charges prepaid, within one year of original purchase.

Third, all products and parts handled by NCRS are guaranteed by the individual manufacturers of those products.

National Camera Repair School further guarantees to check and service any ServiShops product no longer within the warranty period, at nominal charge.

NCRS ORDER BLANK Date _____ 19__

You can order any product advertised in the Camera Craftsman. All products carry the NCRS Return Privilege Guarantee -- Satisfaction or return in 10 days for complete refund!

Shipments are F.O.B. Englewood (Denver), Colo.

Acct. No. _____

Name _____

Street _____

City _____ State _____

How shall we ship? Parcel Post, Railway Express, Other _____

How will you pay? Cash, C.O.D., Other _____

Quantity	Name and Description	Price
	minimum Postage	.30
	Total	

Minimum Order - $2.00 Signature _____

Mr. Ignacio Montalvo Receives Diploma From Mr. Love, President

Mr. Montalvo, student #1456, was sent to NCRS by an agency of the Government of Puerto Rico. Besides completing the regular NCRS Course, Mr. Montalvo also completed 750 hours of training in the ServiShops Headquarters.

While "Monty" was here he told us many interesting things of his native land, accompanied by beautiful pictures of that fascinating country.

"Monty" took back his ServiShops Franchise, ServiShops Motion Analyzer plus other equipment so he can start his Repair Shop immediately. Here's wishing you, "Monty", lots of luck from NCRS!

You will work better when you see better with this new Binocular Magnifier. May be worn with or without eyeglasses. Leaves both hands free to work. Fine tolerance and precision work can be done easier, faster and more accurately using this equipment. With the Magni-Focuser you see an object in third dimension greatly magnified - with depth and clarity. It reduces eye-strain, thereby saving time, increasing accuracy and minimizing the chance of errors and accidents. The head-band is adjustable for your comfort. Normal vision may be resumed by slightly raising your head.

Model No	2 magnifies	at	Price
2	1-1/2 times	20"	$12.50
3	1-3/4	14"	12.50
7	2-3/4	8"	12.50
10	3-1/2	4"	15.00

No 13 and 17 are the same as No 3 and 7 with an auxiliary lens attachment which gives magnification of 4-1/4 and 5-1/4 respectively, with the right eye only. Priced $17.50 each.

order from:

NATIONAL CAMERA ServiShops SUPPLY

Box 174 • Englewood, Colorado

NATIONAL CAMERA REPAIR SCHOOL

Dept. CC1, Box 174
Englewood, Colorado

I am interested in the opportunities and advantages of a career in Camera Craftsmanship. Please furnish me with complete information about your training program.

Name_____ Age _____

Street _____

City _____ State _____

If you have a friend or relative who may be interested in the money making opportunities that exist today in the camera repair field, have him or her fill out this coupon and mail it to the National Camera Repair School, Box 174, Englewood, Colorado.

ServiShops

MOTION ANALYZER

Mark III

"Fast Precision Tests On All Photo Equipment"

The ServiShops Motion Analyzer is a means of visualizing and timing the action of many types of photographic equipment. It is also used for analyzing the operation of many other devices where motion is involved. The Analyzer uses a 5" cathode ray tube and the oscilloscope principle to actually show a graph on the screen of the functioning of the equipment being tested. It can also be used like an ordinary oscilloscope for testing the amplifier of movie sound equipment.

For years, oscilloscope testing of photographic equipment has been accepted as the ultimate in accuracy by manufacturers of photographic equipment. You get a clear, graph-like picture of any action you want to observe. With the ServiShops Motion Analyzer, you can easily analyze and measure:

- Shutter action of all kinds.
- Synchronization contact action.
- The time interval between actions.
- Motion picture equipment or any equipment with a repetitive-type action may be timed to an accuracy of plus or minus two percent. Can be set to time an action of from .0005 to 9.99 seconds.

The Analyzer is ideal for testing new equipment or the quality of a repair or modification. Most important is the fact that you can show your customer these tests while you are making them.

Used by: Graflex, Inc; U. S. Marine Milwaukee Journal; Air Force Photography School; National Theater Supply Company; White Sands Proving Grounds and many other equally famous purchasers.

The versatility of the Analyzer means that you have greater accuracy, wider range, easier operation, and most important; less cost than would be involved in several instruments needed to do similar jobs. The saving of time and the increase in accuracy guarantee you higher earnings.

The ServiShops Motion Analyzer is a precision instrument ruggedly built for shop work and a valuable sales tool. It enlarges shutter action into a picture so that the customer can understand what is taking place. You show what's wrong with his camera instead of telling him. An easy check with the Motion Analyzer convinces him of the need for repair---and later, convinces him that the right repairs have been made.

In the retail store it offers an easy and accurate method of checking new or repaired equipment as it is delivered to the customer. Your sales clerk can operate The Motion Analyzer.

With nine tubes including 5" cathode ray tube. Terms are available.

F.O.B. Denver, Colo. **$395.**

order from:

NATIONAL CAMERA SUPPLY ServiShops

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Cat. No. EII-29-1

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Form 3547 Requested